WHAT IS CLAIMED IS:

1. A method for depositing a silicon carbide layer onto a substrate, the method comprising steps of providing a silicon source, carbon source and oxygen source and an inert gas into a reaction zone, the reaction zone containing the substrate; producing an electric field in the reaction zone, the electric field generated using low and high frequency RF energy produced by an RF power supply, the RF power supply generating an average power at an electrode surface used for plasma discharge in the reaction zone; and reacting the silicon and carbon source gas to deposit a silicon carbide film on the substrate; wherein the RF power supply generates high frequency RF power and low frequency RF power during a processing period.

2. The method of Claim 1, wherein:

the high frequency RF power has a frequency between about 13 MHz and about 30 MHz, and has a power between about 200 watts and about 1000 watts; and

the low frequency RF power has a frequency between about 100 kHz and about 500 kHz, and has a power between about 50 watts and 500 watts.

3. The method of Claim 1, wherein a ratio of the low frequency RF power to a total RF power is less than about 0.5.

4. The method of Claim 1, wherein the average power at the electrode surface is substantially constant.

5. The method of Claim 1, wherein the silicon and carbon source gas is one of the following: tri-methylsilane, tetra-methylsilane, or divinyl-dimethylsilane.

6. The method of Claim 1, wherein the inert gas is one of the following: helium, argon or krypton.

7. A method of Claim 1, wherein the oxygen source in either one of the following or both: Oxygen (O2) or Carbon dioxide (CO2).

8. The method of Claim 1, wherein the ratio of the silicon and carbon source gas to the inert gas is between about 1:1 and about 1:15.

9. The method of Claim 1, wherein the silicon and carbon source gas is provided into the reaction zone at a rate between about 200 sccm and about 500 sccm.

10. The method of Claim 1, wherein the substrate is heated to a temperature between about 200 °C and about 400 °C.

11. The method of Claim 13, wherein the substrate is heated to a temperature between about 320 °C and about 350 °C.

12. The method of Claim 1, wherein the reaction zone is maintained at a pressure between about 300 Pa and about 1000 Pa.

13. The method of Claim 1, wherein the reaction zone is maintained at a pressure between about 500 Pa and about 800 Pa.

14. The method of Claim 1, wherein the silicon carbide film formation compromises the steps of:

i) basic film formation step, where the basic film is formed on the substrate by flowing TMS, O2, He and applying RF power;

ii) active plasma treatment step, where after basic film formation step, second film formation step is carried out continuously, in which He flow is increased while TMS and O2 flow is decreased without changing plasma discharge.

15. The method of claim 14, where the film formation is continued during the active plasma treatment step.

16. The method of Claim 14, wherein the He flow during active plasma treatment steps is increased to a rate of about 1500 sccm to about 3000 sccm.

17. The method of claim 14, wherein the O2 during active plasma treatment step is decreased to a rate of about 50 sccm to 0 sccm.

18. The method of claim 14, wherein the TMS flow during active plasma treatment step is decreased to a rate of about 100 to 0 sccm.

19. The method of claim 14, wherein the He, TMS and O2 during active plasma treatment is increased, decreased and decreased respectively without changing the plasma discharge.

20. The method of claim 14, where a ratio of the low frequency RF power to the total RF power during active plasma treatment step is substantially the same as during the basic film forming step which is less than that of 0.5.

21. The method of claim 14, wherein the pressure during active plasma treatment step is substantially the same as that during the basic film forming step which is maintained at a pressure between about 500 Pa to about 800 Pa.

22. The method of Claim 14, wherein the silicon carbide layer is oxygen-doped, and wherein the oxygen-doped silicon carbide layer has a dielectric constant less than about 3.0.

23. The method of Claim 14, wherein the silicon carbide layer has a leakage current of less than $5x10^{-10}$A/cm2 at an electric field of 1MV/cm.

24. The method of Claim 14, wherein the silicon carbide layer is mechanically strong such as has high elastic modulus and hardness of approximately >10G Pa and >2G Pa respectively when compared to the other low-k films such as fluorosilicate (FSG), hydrogen silisesquioxane (HSQ), methyl silsesquioxane (MSQ), and others like the same.

25. The method of claim 14, where the silicon carbide layer has improved electrical properties, including;

i) higher breakdown voltage

ii) lower leakage current

iii) greater film stability

26. The method of claim 14, wherein the silicon carbide layer minimizes metal diffusion and improves the barrier layer properties.

27. The method of claim 14, wherein the dielectric constant of the silicon carbide layer in tunable, in that it can be varied as a function of the ratio of the mixed frequency RF powers.

28. The method of claim 14, wherein the dielectric constant of the silicon carbide can be tuned as a function of the composition of the gas mixture during film formation.

29. The method according to claim 14, wherein the film is a copper diffusion barrier layer.

30. The method according to claim 14, wherein the film is a low-k film.

31. A method of manufacturing on a semiconductor substrate a structure containing a film in contact with a copper layer, comprising the steps of:

i) forming a silicon carbide layer on a semiconductor substrate by plasma reaction;

ii) forming a via in the silicon carbide layer to expose a portion of the copper layer;

iii) forming a trench in the silicon carbide layer above the via hole, the trench being used to accommodate a metal wiring;

iv) depositing copper in the hole;

v) removing the excess of the copper and resist on top of the silicon carbide layer;

wherein, the silicon carbide layer is an oxygen doped silicon carbide layer formed by a chemical vapor deposition (CVD) process.

32. The method according to Claim 31, wherein in step (ii) the hole is produced by forming a resist on top of the silicon carbide layer and forming a via hole and trench by etching the silicon carbide layer using the resist, and in step (v) by CMP or the like, the resist and the excess copper are removed so that a surface is exposed.

33. The method according to Claim 31, wherein steps (i) through (iv) are repeated at least once.